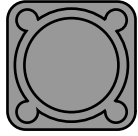
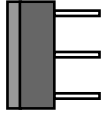


Device = LM2596T-ADJ/NOPB
Topology = Buck
Created = 2023-06-28 04:55:58.775
BOM Cost = NA
BOM Count = 9
Total Pd = 2.08W

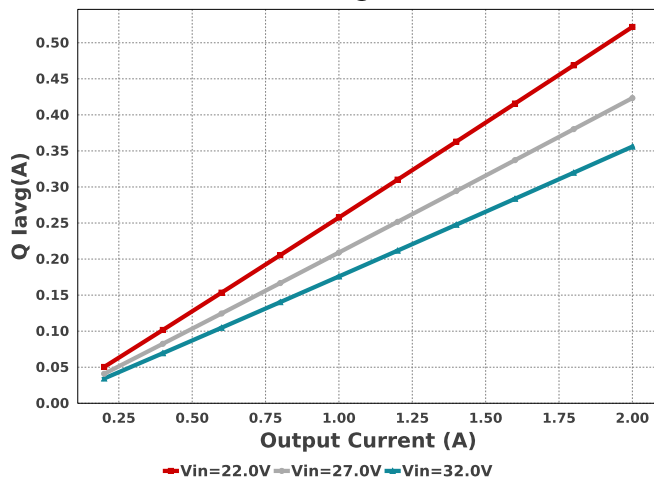
Design : 13 LM2596T-ADJ/NOPB
LM2596T-ADJ/NOPB 22V-32V to 5.20V @ 2A



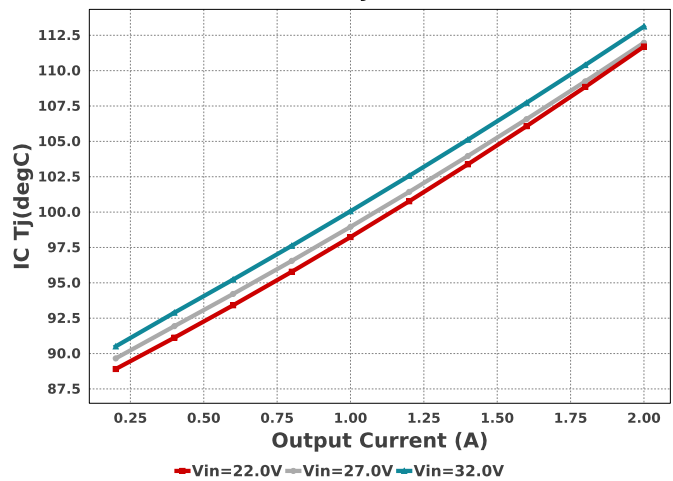
WEBENCH® Design Report LM2596T-ADJ/NOPB : LM2596T-ADJ/NOPB 22V-32V to 5.20V @ 2A June 28, 2023 04:58:30 GMT-05:00

Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
L1	Coilcraft	MSS1210-683MEB	L= 68.0 μ H 68.0 mOhm	1	\$0.81	 MSS1210 204 mm ²
Rfb1	Vishay-Dale	CRCW04021K00FKED Series= CRCW..e3	Res= 1000.0 Ohm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
Rfb2	Vishay-Dale	CRCW04023K24FKED Series= CRCW..e3	Res= 3.24 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
U1	Texas Instruments	LM2596T-ADJ/NOPB	Switcher	1	\$2.18	 TA05F 127 mm ²

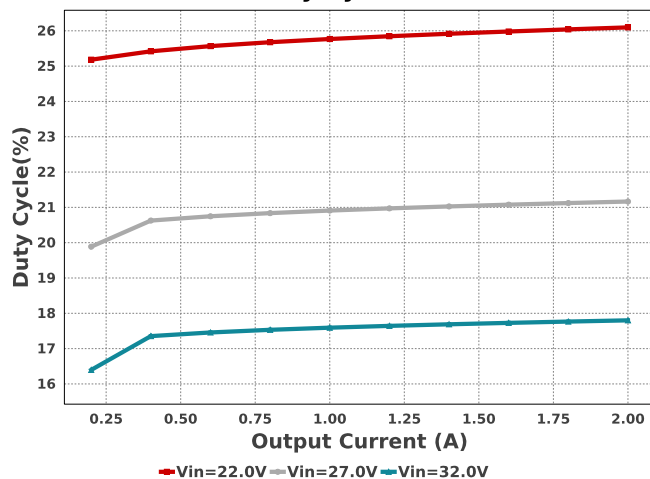
Q lavg



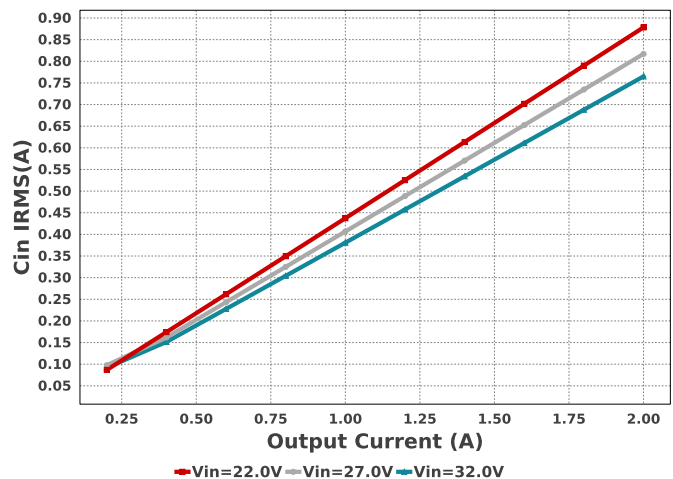
IC Tj

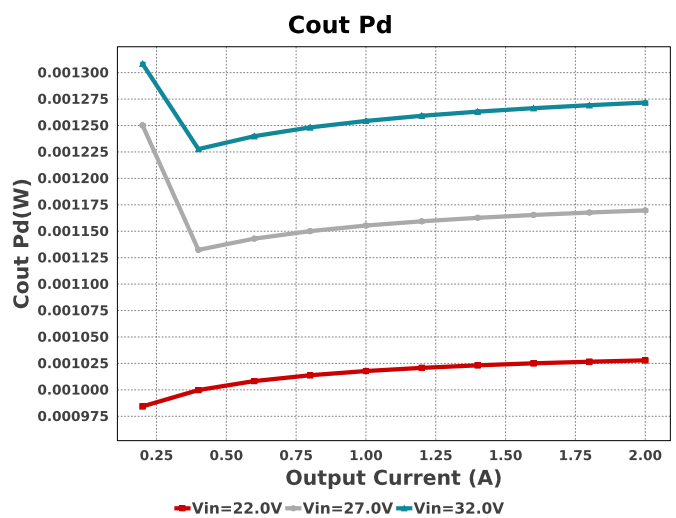
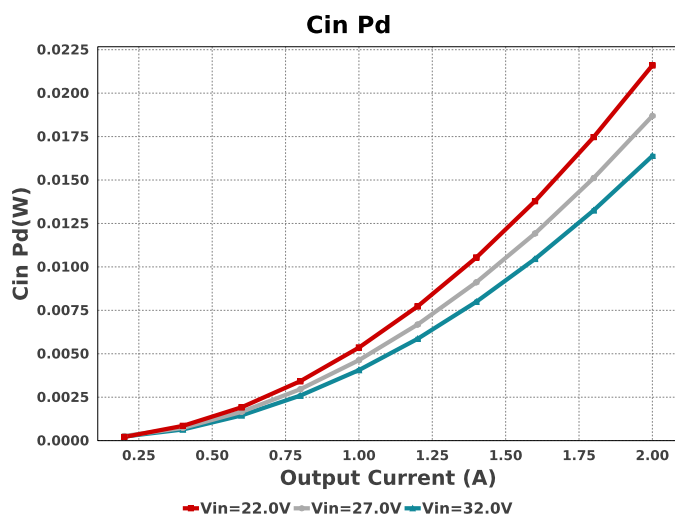
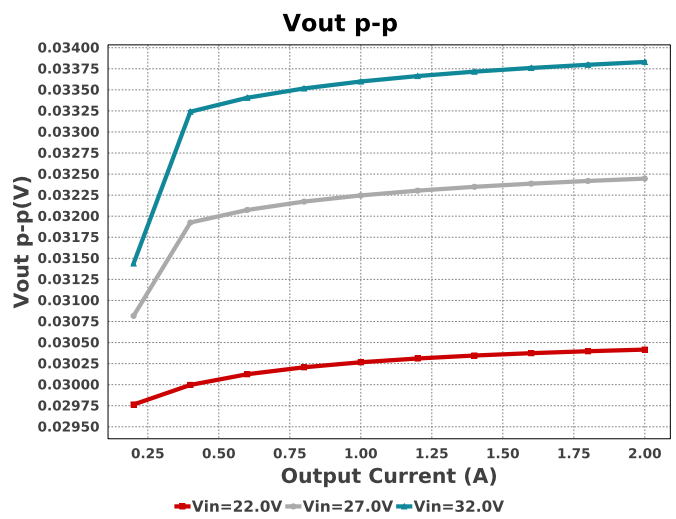
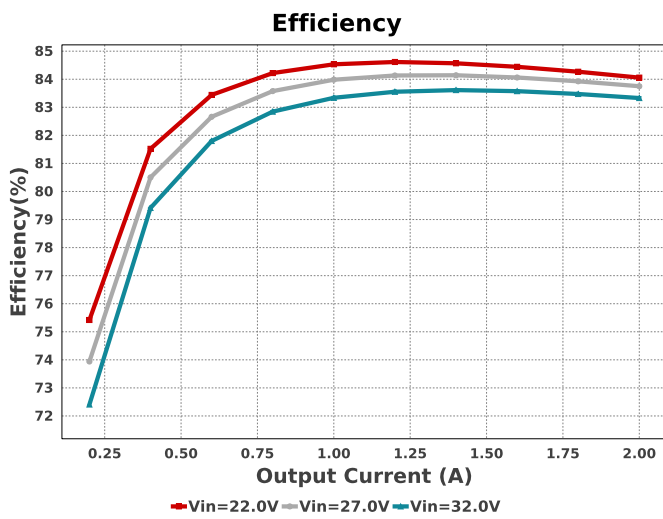
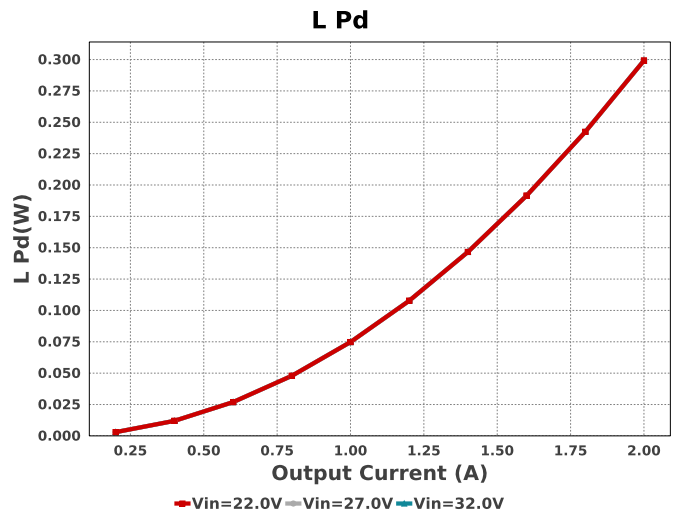
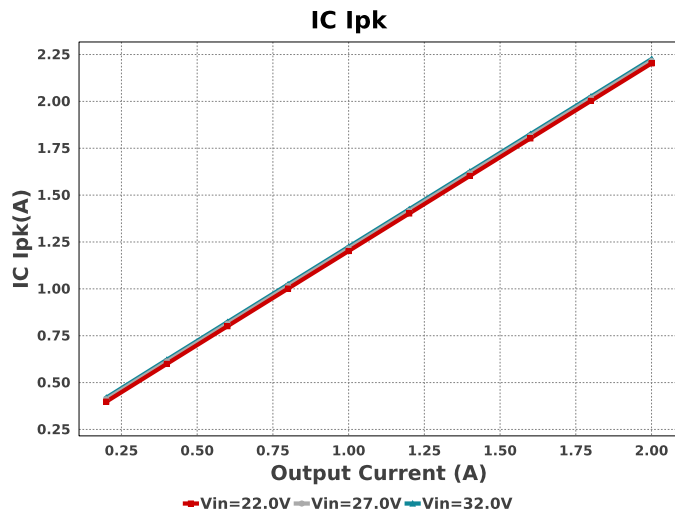


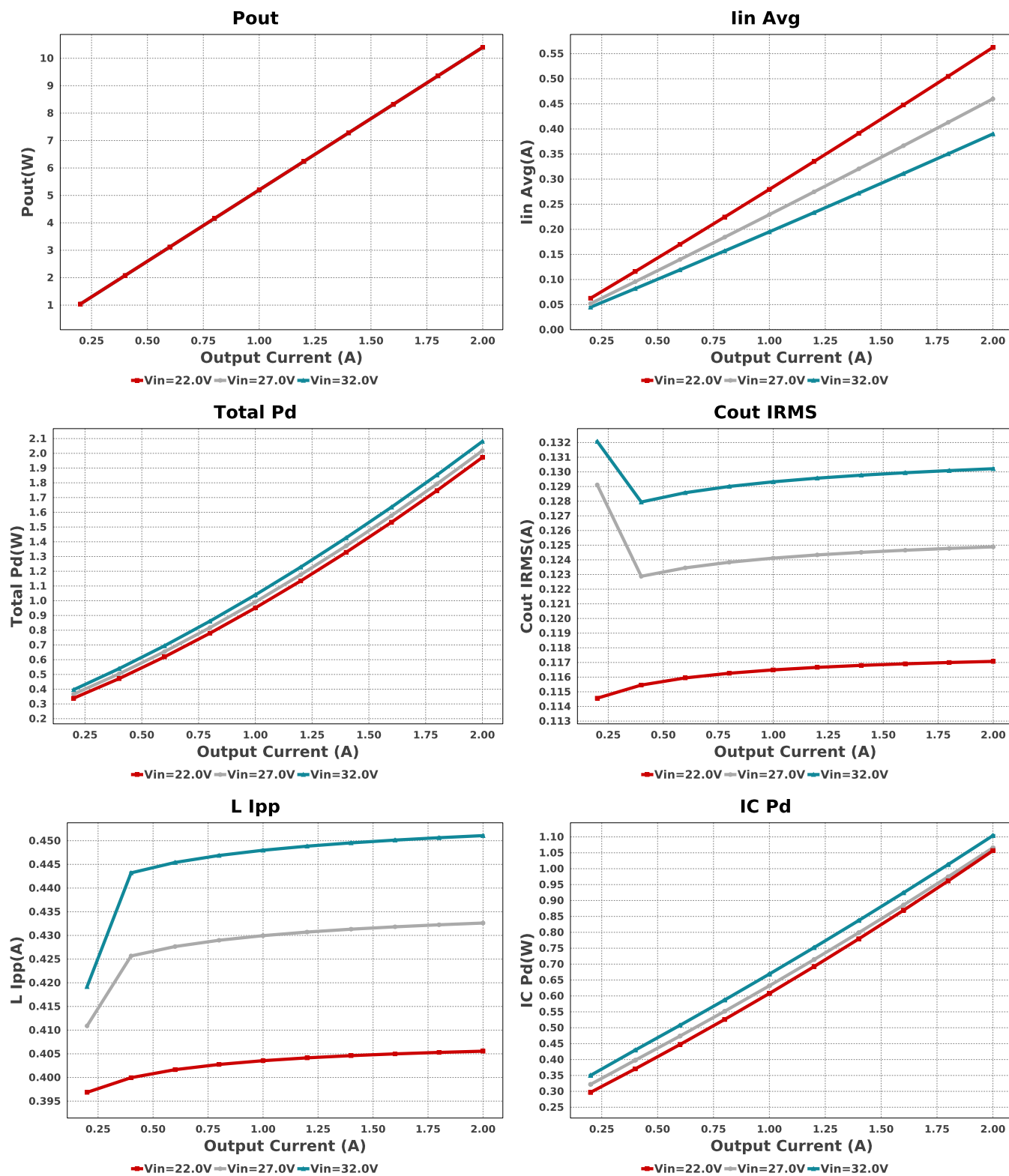
Duty Cycle

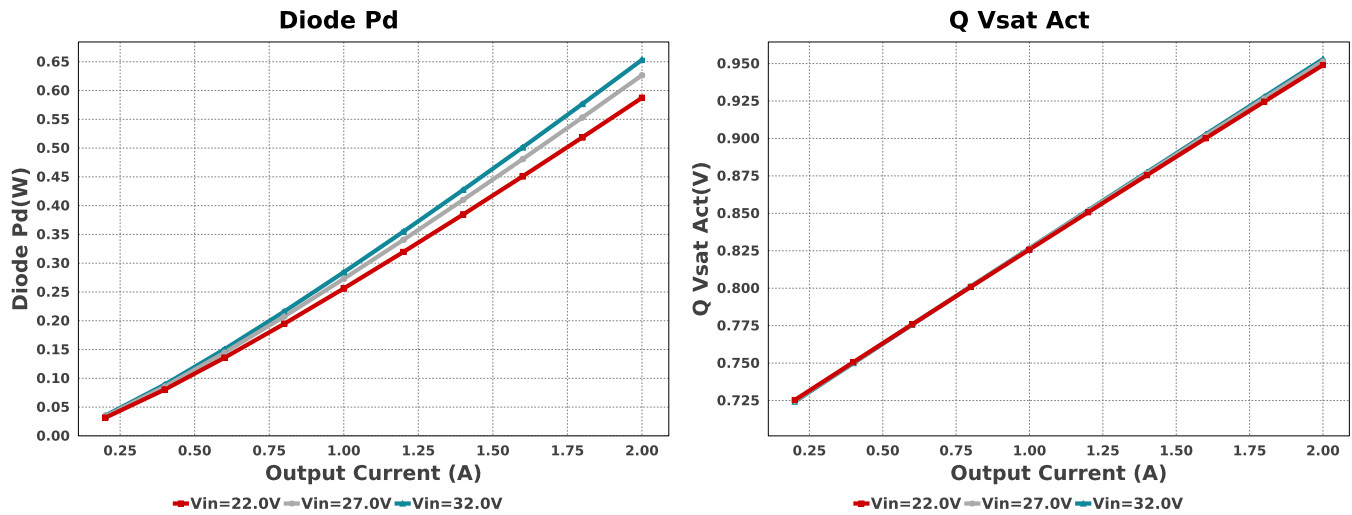


Cin IRMS









Operating Values

#	Name	Value	Category	Description
1.	BOM Count	9		Total Design BOM count
2.	Total BOM	NA		Total BOM Cost
3.	Cin IRMS	765.039 mA	Capacitor	Input capacitor RMS ripple current
4.	Cin Pd	16.388 mW	Capacitor	Input capacitor power dissipation
5.	Cout IRMS	130.215 mA	Capacitor	Output capacitor RMS ripple current
6.	Cout Pd	1.272 mW	Capacitor	Output capacitor power dissipation
7.	Diode Pd	653.26 mW	Diode	Diode power dissipation
8.	IC Ipk	2.226 A	IC	Peak switch current in IC
9.	IC Pd	1.104 W	IC	IC power dissipation
10.	IC Tj	113.121 degC	IC	IC junction temperature
11.	IC Tolerance	0.0 V	IC	IC Feedback Tolerance
12.	ICThetaJA	30.0 degC/W	IC	IC junction-to-ambient thermal resistance
13.	Iin Avg	390.02 mA	IC	Average input current
14.	L Ipp	451.077 mA	Inductor	Peak-to-peak inductor ripple current
15.	L Pd	299.2 mW	Inductor	Inductor power dissipation
16.	Q Iavg	356.017 mA	Mosfet	Q Iavg
17.	Cin Pd	16.388 mW	Power	Input capacitor power dissipation
18.	Cout Pd	1.272 mW	Power	Output capacitor power dissipation
19.	Diode Pd	653.26 mW	Power	Diode power dissipation
20.	IC Pd	1.104 W	Power	IC power dissipation
21.	L Pd	299.2 mW	Power	Inductor power dissipation
22.	Total Pd	2.081 W	Power	Total Power Dissipation
23.	Cross Freq	17.378 kHz	System	Bode plot crossover frequency
24.	Duty Cycle	17.801 %	System Information	Duty cycle
25.	Efficiency	83.33 %	System Information	Steady state efficiency
26.	FootPrint	1.47 k mm ²	System Information	Total Foot Print Area of BOM components
27.	Frequency	150.0 kHz	System Information	Switching frequency
28.	Iout	2.0 A	System Information	Iout operating point
29.	Mode	CCM	System Information	Conduction Mode
30.	Phase Marg	71.836 deg	System Information	Bode Plot Phase Margin
31.	Pout	10.4 W	System Information	Total output power
32.	Vin	32.0 V	System Information	Vin operating point
33.	Vout Actual	5.215 V	System Information	Vout Actual calculated based on selected voltage divider resistors
34.	Vout Tolerance	1.544 %	System Information	Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable
35.	Vout p-p	33.831 mV	System Information	Peak-to-peak output ripple voltage
36.	Q Vsat Act	952.977 mV	Transistor	Q Vsat

Design Inputs

Name	Value	Description
Iout	2.0	Maximum Output Current
VinMax	32.0	Maximum input voltage
VinMin	22.0	Minimum input voltage
Vout	5.2	Output Voltage
base_pn	LM2596	Base Product Number
source	DC	Input Source Type
Ta	80.0	Ambient temperature

WEBENCH® Assembly

Component Testing

Some published data on components in datasheets such as Capacitor ESR and Inductor DC resistance is based on conservative values that will guarantee that the components always exceed the specification. For design purposes it is usually better to work with typical values. Since this data is not always available it is a good practice to measure the Capacitance and ESR values of C_{in} and C_{out} , and the inductance and DC resistance of $L1$ before assembly of the board. Any large discrepancies in values should be electrically simulated in WEBENCH to check for instabilities and thermally simulated in WebTHERM to make sure critical temperatures are not exceeded.

Soldering Component to Board

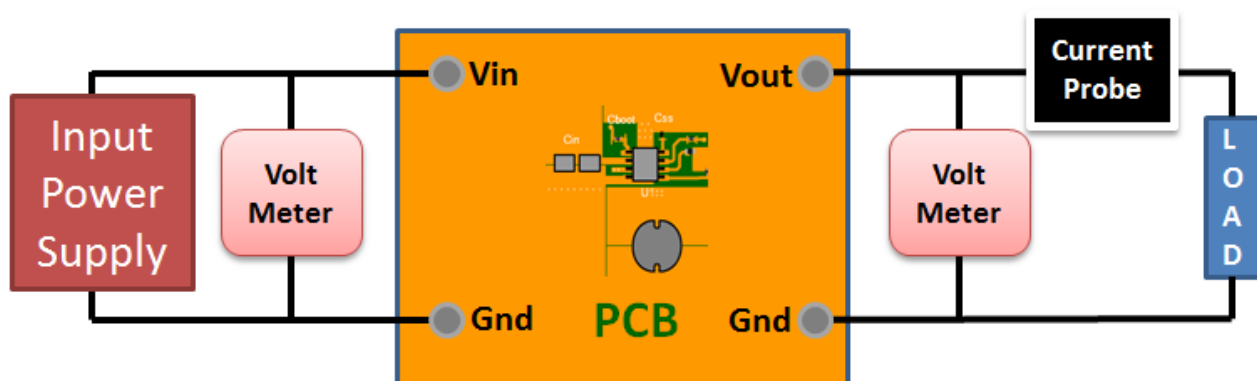
If board assembly is done in house it is best to tack down one terminal of a component on the board then solder the other terminal. For surface mount parts with large tabs, such as the DPAK, the tab on the back of the package should be pre-tinned with solder, then tacked into place by one of the pins. To solder the tab down to the board place the iron down on the board while resting against the tab, heating both surfaces simultaneously. Apply light pressure to the top of the plastic case until the solder flows around the part and the part is flush with the PCB. If the solder is not flowing around the board you may need a higher wattage iron (generally 25W to 30W is enough).

Initial Startup of Circuit

It is best to initially power up the board by setting the input supply voltage to the lowest operating input voltage 22.0V and set the input supply's current limit to zero. With the input supply off connect up the input supply to V_{in} and GND. Connect a digital volt meter and a load if needed to set the minimum load of the design from V_{out} and GND. Turn on the input supply and slowly turn up the current limit on the input supply. If the voltage starts to rise on the input supply continue increasing the input supply current limit while watching the output voltage. If the current increases on the input supply, but the voltage remains near zero, then there may be a short or a component misplaced on the board. Power down the board and visually inspect for solder bridges and recheck the diode and capacitor polarities. Once the power supply circuit is operational then more extensive testing may include full load testing, transient load and line tests to compare with simulation results.

Load Testing

The setup is the same as the initial startup, except that an additional digital voltmeter is connected between V_{in} and GND, a load is connected between V_{out} and GND and a current meter is connected in series between V_{out} and the load. The load must be able to handle at least rated output power + 50% (7.5 watts for this design). Ideally the load is supplied in the form of a variable load test unit. It can also be done in the form of suitably large power resistors. When using an oscilloscope to measure waveforms on the prototype board, the ground leads of the oscilloscope probes should be as short as possible and the area of the loop formed by the ground lead should be kept to a minimum. This will help reduce ground lead inductance and eliminate EMI noise that is not actually present in the circuit.



Design Assistance

1. Master key : D329269B5F955765FD591E4DA19DD2A9[v1]
2. **LM2596** Product Folder : <http://www.ti.com/product/LM2596> : contains the data sheet and other resources.

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